Guest Editorial

Ocean Health and Human Health

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Oceans cover 70% of the Earth's surface, and they profoundly influence many biological and physical processes of the planet. Moreover, 60% of the human population lives on or near the coast. Thus, it almost goes without saying that ocean health and human health are inextricably linked. Recently, however, these linkages have become more conspicuous to scientists (e.g., Knap et al. 2002) and policy makers (e.g., Oceans and Human Health Act 2003) with the precipitous decline in the health of the oceans themselves.

The most obvious problems stem from our propensity to view dilution as the solution to pollution. Human numbers continue to grow, as do per capita amounts of waste, and much of this waste ultimately finds its way into the ocean. Some waste is toxic, some carries human pathogens, and some alters marine food chains in ways detrimental to human well-being. The links between human and ocean health often grab the public's attention via local events such as beach closures and seafood contamination from sewage, but the geographic scale of our impacts on ocean ecosystems is global, reaching even remote human populations (Knap et al. 2002).

The impact of these effluents on our health is aggravated by our tendency to eat high on the marine food chain. Our diet from land sources is dominated by plants and by animals that eat plants, whereas the part of our diet from the sea is primarily animals that eat animals, thereby concentrating toxic compounds to a greater extent. Our increasing dependence on farmed fish, because of the overfishing of wild stocks, has aggravated the problem. For example, in a recent report, Hites et al. (2004) documented that farmed salmon have significantly higher concentrations of organochlorine contaminants than do wild salmon. European farmed salmon had the highest concentrations, which the authors attributed to contamination of fish feed derived from small pelagic fish harvested from industrialized European waters. Remarkably, contaminant levels in some cases were so high that recommended intakes were less than one-half a meal per month based on U.S. Environmental Protection Agency cumulative risk assessments (Hites et al. 2004).

In other cases our impacts are less direct but no less serious. Toxic algal blooms (e.g., red tides) are increasingly common in coastal areas worldwide (Knap et al. 2002). As with pollutants, the toxins from these blooms are concentrated as they move up the food chain, but they can also cause human health problems through skin and aerosol contact. The reasons for the proliferation of algal species that produce toxins remain unclear, with elevated nutrients, removal of filter feeders such as oysters, and transport of contaminated ballast water among the suggested culprits. Symptoms include nausea, respiratory problems, and memory loss, with fatality rates exceeding 10% in some cases.

Warmer oceans associated with anthropogenically mediated climate change also pose risks for human health (Harvell et al. 2002). The best-documented case is cholera, whose causative agent, *Vibrio cholerae*, can be transported in seawater. Because many other human pathogens can be found in seawater, there is good reason to fear that warmer seas will result in a sicker world, as pathogen development rates and geographic ranges increase.

Ultimately, as the oceans become increasingly barren, human nutrition suffers. Over 2 billion people worldwide depend on marine resources for a substantial portion of their dietary protein. We have already eaten about 90% of the big fish that live on continental shelves and the open ocean (Myers and Worm 2003), and in many coastal waters densities have been reduced to a far greater extent. Although the affluent are for the moment buffered by global markets, developing countries with large impoverished coastal populations are already suffering the nutritional impact of worldwide overfishing.

Alarms have been sounding about the health of the oceans for some time, but most of the discussion has been limited to marine organisms themselves, as if people were somehow divorced from the ecosystems upon which they depend for their health and well-being. Sadly, it is no longer possible to ignore the fact that corals and fishes are not the only things suffering from our poor stewardship of the sea around us.

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